

WHAT WE CLAIM IS:

1. A method of producing a biodegradable foamed product including the steps of:

(a) placing a raw biodegradable material into a mould;

(b) locating the mould in a microwave cavity;

(c) conducting a microwave heating cycle;

characterised in that during step (c) the raw material is subjected to at least one controlled pressure increase and decrease using a compressed gas.

2. The method of claim 1 wherein the compressed gas is air.

3. The method of either claim 1 or claim 2 wherein the compressed gas is not pre-treated.

4. The method as claimed in any of the above claims wherein the raw biodegradable material is derived from starch, cellulose, protein or a derivative of starch, cellulose, or protein and combinations thereof.

5. The method as claimed in any of the above claims wherein the raw material has a moisture content in the order of 15 to 50% wt.

6. The method as claimed in any of the above claims wherein the raw biodegradable material is pre-formed by a heat and shear process into pellets.

7. The method as claimed in any of the above claims wherein step (c) is completed in under one minute.

8. The method as claimed in any of claims 1 to 6 wherein step (c) is completed

in the order of 30 seconds.

9. The method as claimed in any of the above claims wherein the increased pressure is maintained for over half of the duration of step (c).
10. The method as claimed in any of the above claims wherein the raw material is subjected to a pressure of between 1.5 and 100 bar during step (c).
11. The method as claimed in any of claims 1 to 9 wherein the raw material is subjected to a pressure of between 3 and 20 bar during step (c).
12. The method as claimed in any of the above claims wherein microwave heating continues after the pressure is decreased during step (c).
13. The method as claimed in any of the above claims wherein the pressure decrease occurs at a rate of 0.001 to 200 bar per second.
14. The method as claimed in any of the above claims wherein the pressure is decreased rapidly at a rate of 0.5 to 10 bar per second during step (c).
15. The method as claimed in any of the above claims wherein the timing and rate of pressure decrease is matched to the temperature profile for the raw material.
16. The method as claimed in any of the above claims wherein the pressure decreases within 0.1 to 10 seconds.
17. The method as claimed in any of the above claims wherein the pressure decrease occurs as one continuous pressure drop.
18. The method as claimed in any of the above claims wherein the pressure decrease commences in the last half of the overall time to complete step (c).

19. The method as claimed in any of the above claims wherein the raw material is subjected to a pressure increase before step (c) commences.

20. The method as claimed in any of the above claims wherein the raw material is preheated before step (c) commences.

21. The method as claimed in claim 20 wherein the raw biodegradable material is preheated to a temperature below the raw biodegradable material melt temperature.

22. The method as claimed in any of the above claims wherein the mould is substantially microwave transparent and is coated with a susceptor material.

23. The method as claimed in any of the above claims wherein the mould includes vents.

24. A biodegradable foamed product produced in accordance with the method as claimed in any of claims 1 to 23.

25. A biodegradable foamed product with a thickness of up to approximately 1 metre manufactured from a biodegradable raw material with properties including:

(a) a density from 10 to 100 kg/m³;

(b) a soft and resilient structure;

(c) cushioning G-value characteristics to cushion an object with a fragility of 15 to 115;

(d) a surface abrasion comparable to polystyrene.

26. An apparatus for the production of a foamed product with a thickness of up to approximately 1 metre including:

- (a) a cavity;
- (b) a mould capable of containing a raw material that is able to be melt processed when subjected to heat and pressure treatment to form a foam;
- (c) at least one magnetron capable of microwave heating the raw material in a microwave heating cycle;
- (d) at least one inlet through which a compressed gas passes; and,
- (e) at least one outlet for depressurisation;

characterised in that the apparatus is capable of subjecting the raw material to controlled pressure increases and decreases using compressed gas in conjunction with microwave heating.

27. The apparatus as claimed in claim 26 wherein the compressed gas is air.
28. The apparatus as claimed in either claim 26 or claim 27 wherein the apparatus further includes a sealed chamber within which the mould and raw material are placed, the chamber is positioned inside the apparatus cavity, and the chamber containing the mould and raw material, is pressurised.
29. The apparatus as claimed in any of claims 26 to 28 wherein the outlet is a valve.
30. The apparatus as claimed in any of claims 26 to 29 wherein the magnetrons are capable of heating the raw material at a rate of up to 25°C per second.
31. The apparatus as claimed in any of claims 26 to 30 wherein the magnetrons operate at a frequency from approximately 915 MHz to 5 GHz.

32. The apparatus as claimed in any of claims 26 to 30 wherein the magnetrons operate at a frequency of an approximately constant level of 2450 MHz.
33. The apparatus as claimed in any of claims 26 to 32 wherein the apparatus includes at least one pressure window manufactured from a substantially microwave transparent material and located between a waveguide exit point and the cavity.
34. The apparatus as claimed in claim 33 wherein the window includes a sacrificial window.
35. The apparatus as claimed in any of claims 26 to 34 wherein the apparatus includes an injection point through which raw material can be inserted into the mould.
36. The apparatus as claimed in any of claims 26 to 35 wherein the mould is substantially microwave transparent and is coated with a susceptor material.